

REMARKS

In the Office Action of January 19, 2005, the Examiner rejected claims 1-3, 5, 6, 8, 9, 11, 13, 22, 23 and 25-30 under 35 U.S.C. §103(a) as being unpatentable over "Admitted Prior Art by Applicant (APAA) in view of the publication of Kim et al (Applied Physics Letters 71(6), 800-802 (1997)). Applicant respectfully disagrees with these rejections for the reasons provided below.

The Examiner also rejected dependent claims 14, 15, 20 and 21 and independent claim 24 under 35 U.S.C. §103(a) as being unpatentable over "APAA" and Kim et al as applied to claims 1 and 13 above, and further in view of US Patent 6,242,766 to Tateno. Applicant respectfully disagrees with these rejections for the reasons provided below and because there is no motivation to combine these three references, and even if combined, they do not disclose all claimed limitations. Due to a relatively large number of claims, Applicant cancelled *without prejudice* claims 14 – 21, 24 and 25. These claims will be pursued in a continuation application.

Importantly, Applicant described prior art in the Background, but provided *no admission* that, for example, the prior art shown in Fig. 3 discloses anything else than a GaN – AlGaN high electron mobility transistor. There is no admission in the Background that would in any way suggest any modification away from GaN – AlGaN. Furthermore, there is no admission of any motivation to combine the device of Fig. 3 (referred by the Examiner as "AAPA") with the teaching of Kim et al.

Applicant respectfully submits that the Examiner failed to establish the *prima facie* case of obviousness. As described below, the device of Fig. 3 cannot even be properly combined with the teaching of Kim et al., and even if combined, such combination does not disclose the invention claimed in any one of the independent claims 1, 4, 13, 22, 23, 26 or 37.

When making the above rejections, the Examiner stated:

APAA does not teach said barrier layer to include $In_xAl_{1-x}N$ with x being in the range $0 \leq x \leq 0.3$. However, it would have been obvious to include $In_xAl_{1-x}N$ in

said barrier layer in view of the specific teaching by Kim et al, who specifically teach the selection of $\text{In}_x\text{Al}_{1-x}\text{N}$ as a superior material for a heterojunction barrier layer abutting GaN in *inter alia* high electron mobility transistors (cf. title, abstract and page 802, first column, central paragraph) because of an achievable band-gap energy difference with the abutting GaN layer of at least 670 meV (loc.cit.) (for a lattice-matched system, portending higher mobility due to fewer scattering centers) and as high as 970 meV (loc.cit.) for $x=0.17$ (*claim 2*). The value of the stoichiometric parameter in the prior art is preferably $x=0.08$, which overlaps with the range as claimed, or $x=0.17$. Applicant is reminded that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. *In re Peterson*, 65 USPQ2d 1379 (CA FC 2003). *Motivation* to include the teaching by Kim et al in the APAA at least directly connects to the high band-gap energy jump at the interface, thus increasing the density of electrons confinable (loc. cit.).

Applicants respectfully disagree with the above statements:

1. It would not have been obvious to include $\text{In}_x\text{Al}_{1-x}\text{N}$ in the barrier layer in the cation-polarity layered structure after reading the teaching by Kim et al. On page 802, Kim discloses energy band gap difference “as being sufficiently large for effective confinement of carriers at the heterojunction or quantum well former by AlInN/GaN .” However, while this perhaps may be relevant for modulation-doped high-electron mobility transistors, this is not relevant for the polarization-induced transistors claimed in the present claims.
2. The cited statement: “because of an achievable band-gap energy difference with the abutting GaN layer of at least 670 meV (loc.cit.) (for a lattice-matched system, portending higher mobility due to fewer scattering centers) and as high as 970 meV (loc.cit.)...” may perhaps be relevant to modulation-doped high-electron mobility transistors. The claimed invention is directed to a device having a polarization-induced charge located in a channel layer of a cation-polarity layered structure.

Applicants respectfully believe that the Examiner had perhaps in mind a different device; that is, the modulation-doped high electron mobility transistor, where (1) the barrier layer is n-type doped, and (2) there is a band-gap energy jump (ΔE_C) at the

barrier - channel interface (with a band-gap of the barrier being wider than the band-gap of the channel).

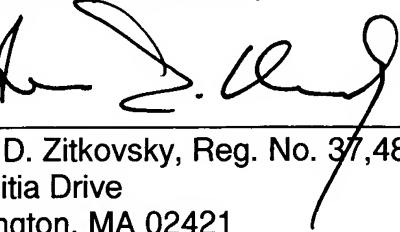
Regarding the pending claims, the Examiner has not specifically shown that the prior art may be modified to arrive at the claimed invention. Furthermore, even if the prior art is combined and modified, the prior art does not disclose all claim limitations. Importantly, in the claimed layers, composition plays important role. A slightly different composition provides a layer having different properties and thus different devices. As shown, for example, in Figs. 4B, 5A, 5B or 5C, a different structural composition leads to different QW structures, in these cation-polarity devices, and thus to different device characteristics. Therefore, *In re Peterson*, 65 USPQ2d 1379 (CA FC 2003), cited by the Examiner is completely inapplicable to the present claims.

In summary, Applicant respectfully submits that the Examiner failed to establish the *prima facie* case of obviousness.

In short, independent claims 1, 4, 13, 22, 23, 26, and 37 are nonobvious over the cited prior art. Dependent claims 2, 3, 5-12, 27 – 36 and 38 – 42 include additional novel features. Accordingly, all claims are allowable and such action is respectfully requested.

If there is any outstanding issue left, the Examiner is respectfully invited to call the undersigned representative. If there are any additional fees due in connection with the filing of this response, please charge the fees to undersigned's Deposit Account No. 50-2196.

Respectfully submitted,


Ivan D. Zitkovsky, Reg. No. 37,482
5 Militia Drive
Lexington, MA 02421

Tel. +781-274-6692
Fax +781-274-6696

**CERTIFICATE OF MAILING
UNDER 37 C.F.R. §1.8(a)**

The undersigned hereby certifies that this document is being placed in the United States mail with first-class postage attached, addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on


June 20
2005
Ivan D. Zitkovsky

Amendments to the Drawings

In Figs. 1, 1A, 2, and 3A, please insert: --PRIOR ART--